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(54) IMPROVEMENTS RELATING TO CONSTRUCTION EQUIPMENT FOR SUPPORTING SHUTTERING OF TRENCHES

(71) We, EMUNDS & STAUDINGER oHG of 5142 Huckelhöven, Lambertusstrasse 6, Federal German Republic, an offene Handelsgesellschaft organised and existing under the laws of the Federal German Republic, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to construction equipment for supporting shuttering of trenches.

Such construction equipment generally comprises oppositely arranged support plates, which are interconnected by spreader-props providing the required distance therebetween. In such equipment the props conventionally comprise screw-threaded spindles which make it possible for the support plates to be spaced apart by a required amount and which moreover also make it possible to relieve the soil pressure exerted on the support plates by releasing the spindles, when dismantling the equipment. In practice releasing of the spindles presents considerable difficulties, since, particularly if the construction site has been in existence for a fairly long period, the screw threads of the spindles have become rusty or the spindles have been subjected to a bending stress of such a magnitude that the spindles cannot be released from their associated sleeves.

Construction equipment has also previously been proposed in which the props comprise hydraulic cylinders, so that the disadvantages described above do not apply in that case.

In these hydraulically adjustable props previously proposed, the operating cylinder is connected to a first portion of the prop and the piston is connected to a second portion of the prop via a piston rod. The props of the construction equipment are connected via pressure medium conduits and manually openable valves to a hydraulic unit which pumps oil into the operating cylinder as required. By opening the valves, the oil flows from the operating cylinder back to the hydraulic unit if the support plates are subjected to soil pressure.

These previously proposed forms of construction equipment are expensive to manufacture and require careful maintenance and servicing. These props moreover have the disadvantage that a hydraulic unit has to be permanently available at the building site.

It is an object of the present invention to provide construction equipment comprising at least one spreader-prop by means of which the disadvantages referred to are reduced or eliminated.

According to the invention, construction equipment for supporting shuttering of trenches comprises at least one spreader-prop comprising a first and a second portion, said first portion of said prop including a cylinder which is arranged to be supplied with a fluid pressure medium and which extends longitudinally of the prop, said second portion of the prop including a piston rod connected to a piston which is reciprocable in the cylinder and arranged to be subjected to pressure of said medium, wherein a pressure medium chamber is connected to, so as to be in fluid communication with, the cylinder via a non-return valve which allows flow from the pressure medium chamber to the cylinder, manually operable means being provided to cause fluid communication between the cylinder and the pressure medium chamber, the volume of the pressure medium chamber being variable by means of a movable barrier, and means being provided for exerting, when the prop is in use, a resilient biasing force on the barrier which tends to reduce the space between the barrier and the non-return valve.

In this equipment, the biasing means of said at least one prop forces oil or some other suitable fluid pressure medium into the cylinder via the non-return valve, to cause the piston to move to that end of the cylinder such that the prop is fully extended. Thus, in construction equipment embodying the present invention, any initial length adjustment of any one of the props which may be required is not performed hydraulically, but may be provided in known manner by means of a screw-threaded spindle or by members telescopically displaceable within each other, which may be set in different relative positions by means of set screws or the like.

Thus any prop, in equipment according to the invention, in its unstressed condition automatically becomes extended by a set amount and is in a position to accommodate the forces acting on the support plates without yielding. In order to release the prop when dismantling the construction equipment, it is merely necessary to open the valve between the said cylinder and the pressure medium chamber manually. By means of the soil pressure acting on the support plates, the oil in the cylinder is at least partly pushed back into the pressure medium chamber and the biasing means acting on the movable barrier is stressed.

A second valve between the cylinder and the pressure medium chamber (viz. for providing the fluid communication as aforesaid) may be provided, but this may be dispensed with, if the non-return valve is so designed that it can be over-ridden manually.

Desirably the biasing means acting on the movable barrier takes the form of a pneumatic spring. The space between the barrier and the remaining portion of the pressure medium chamber, which is remote from the cylinder, is charged with a compressed gas, so that the prop, when unstressed, is always capable of returning to its propping or fully extended position.

The movable barrier in the pressure medium chamber may be in the form of a diaphragm, preferably a rolling diaphragm. Desirably the pressure medium chamber is also cylindrical and has the same diameter as the said cylinder. Both the said cylinder and the pressure medium chamber are then arranged axially, one behind the other, in a rigid housing and separated by an intermediate wall, which has an axial bore in which the manually operable non-return valve is arranged.

Two forms of prop for use in construction equipment embodying the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is an end view of construction equipment embodying the invention showing two props;

Figure 2 is a fragmentary longitudinal section of a first said form of prop, including a washing cylinder and a cylindrical pressure medium chamber; and

Figure 3 is a longitudinal section corresponding to Figure 2 of a modified or second form of said prop.

The construction equipment shown in Figure 1 consists of two support plates 1 and 2, which are held apart and united to form a unit by two props 3. The ends 4 and 5 of the props 3 are pivotally supported by abutment posts 6 which are secured to the insides of the support plates 1 and 2. Relatively rigid compression springs 7 are so arranged between the abutment posts and the upper prop 3, that the props are disposed at right angles to the support plates. The stiff springs 7 render the construction equipment stable.

The props 3 each comprise two tubular sections 8 and 9 which are telescopically insertable one within the other and which are relatively adjustable by means of set screws 10. As an alternative to the two tubular sections 8 and 9, conventional screwed spindles could be used, to provide the facility of stepless adjustment of the prop lengths.

The end 4 of the prop is connected to a working cylinder 11 in which is guided a piston 12 to which a hydraulic force may be applied and whose piston rod 13 is coupled to the members 8 and 9 of the prop 3 which are connected to the other end 5 of the prop.

As shown in Figures 2 and 3, the cylinder 11 is connected, via a non-return valve 14 which opens in the direction of the cylinder 11, with a pressure medium chamber 15 whose size is variable by means of a movable barrier 16 which has a force applied to it by resilient biasing means hereinafter described, which tend to reduce the space between the barrier 16 and the non-return valve 14. The pressure medium chamber 15 and a chamber 17 of said resilient biasing means are relatively separated by a piston 19 which defines the movable barrier 16. The pressure medium chamber 15 and the chamber 17 define a common cylinder, whose cross-section corresponds to the cross-section of the cylinder 11. An intermediate wall 20 separates the cylinder 11 from the pressure medium chamber 15.

In the prop shown in Figure 2, the pressure medium chamber 15 and the cylinder 11 may, via a non-return valve 21, be charged with a pressure medium, preferably oil. The chamber 17 may be charged, via a non-return valve 22, with compressed air or some other gas thereby

defining pneumatic resilient biasing means. The non-return valve 14 may be opened manually, viz. in the direction from the cylinder 11 to the pressure medium chamber 15, by means of a hand lever 23, a shaft 24, a cam 25 and a stem 26, which, depending on the position of the hand lever 23, forces open the non-return valve 14. In order to prevent the shaft 24 with the hand lever 23 protruding beyond the perimeter of the prop 3, the hand lever 23 together with the protruding portion of the shaft 24 may take the form of a removable socket wrench or key. In order to relieve the soil pressure on the prop, for the purpose of removing the latter, it is merely necessary to operate the handle 23 in such a way that the non-return valve 14 is opened. If the prop is subjected to a force which exceeds the small force resulting from the pre-stressing applied, then the piston 12 displaces the pressure medium into the pressure medium chamber 15 and at the same time compresses the gas in the chamber 17, acting on the barrier 16 or, as the case may be, a compression spring enclosed in the chamber 17. The degree of pre-stressing may be adjusted, e.g. by appropriate selection of the gas pressure, and precisely adapted to the requirements.

The free end of the piston rod 13 is provided with a dished guide member 29, which is inserted via an external screw thread 30 in an internal screw thread of the tubular prop member 9. The dished guide member 29 surrounds a cylindrical head portion 33 of a cylinder housing 18, so that the cylindrical internal wall 31 of the member 29 slides over the cylindrical external wall 32 of the head portion 33. The dished guide member 29 and the cylindrical external wall 32 of the head portion 33 have axial grooves into which a cylindrical pin 35 is inserted to prevent relative rotation.

In the embodiment shown in Figure 3, the parts of the prop which correspond to those in the form of prop shown in Figure 2 are designated by the same reference numerals. The cylinder 11, the pressure medium chamber 15 and the chamber 17 are surrounded by a cylindrical housing 18, one end of which is welded to a coupling disc 45, which is connectable to a coupling disc 46 of the prop member 47. The cylinder 11 is bounded by an intermediate wall 20 inserted therein and a head member 33 screwed to the cylinder 11. The chamber 17 is bounded by an axially displaceable barrier 19 and a base 48 inserted in the end of the cylinder 18 connected to the coupling disc 45. The base 48 is held by a circlip and sealed against the cylinder wall by an *O*-ring. Via a valve 22 inserted in the base 48 the chamber 17 can be charged with compressed air or other gas. The cylinder 11 and the pressure medium chamber 15 can be charged with oil before the piston 12 is inserted and the head member 33 screwed on. In the piston rod 13 a bore 50 is provided which extends into the cylinder 11 and which can be closed by a valve 51 and/or a screw 52. Via this bore 50 any excess oil can be drained off or any oil deficiency made up. The dished guide member 29 is secured to the piston rod 13 by means of the screw 52.

The non-return valve can be opened manually by pressing the screw threaded spindle 40, which is adjustable by means of a handle 23, against a ball 41 which rests on an inclined plane 42 of a valve stem 43, whereby the point of the valve stem 43 displaces a valve member 14 of the non-return valve so as to open the latter against the action of a return spring (not shown). An end 44 of the valve stem 43 adjacent the valve member 14 is axially displaceably guided in the intermediate wall 20 and the end of the stem 43 which has the inclined plane is axially displaceably guided in the base 48. The displaceable barrier 19 is defined by a piston of resilient material, whose periphery 53 which slides along the cylinder wall and periphery 54 which slides along the wall of the valve stem 43 define sealing lips.

WHAT WE CLAIM IS:—

1. Construction equipment for supporting shuttering of trenches, said equipment comprising at least one spreader-prop comprising a first and a second portion, said first portion of said prop including a cylinder which is arranged to be supplied with a fluid pressure medium and which extends longitudinally of the prop, said second portion of the prop including a piston rod connected to a piston which is reciprocable in the cylinder and arranged to be subjected to pressure of said medium, wherein a pressure medium chamber is connected to, so as to be in fluid communication with, the cylinder via a non-return valve which allows flow from the pressure medium chamber to the cylinder, manually operable means being provided to cause fluid communication between the cylinder and the pressure medium chamber, the volume of the pressure medium chamber being variable by means of a movable barrier, and means being provided for exerting, when the prop is in use, a resilient biasing force on the barrier which tends to reduce the space between the barrier and the non-return valve.

2. Equipment according to Claim 1, wherein the means for exerting the biasing force of said at least one prop are defined by a chamber which is adapted to be, and when the prop is in use is, charged with a compressed gas.

3. Equipment according to Claim 1 or Claim 2, wherein the movable barrier of said at least one prop is formed by a diaphragm.

4. Equipment according to Claim 2, wherein the pressure medium chamber and the biasing means chamber of said at least one prop are cylindrical and coaxial with the said cylinder, and the movable barrier is in the form of a piston.

5. Equipment according to any one of the preceding claims, wherein the said cylinder and the pressure medium chamber of said at least one prop are arranged axially one behind the other in a rigid cylindrical housing and separated by an intermediate wall which has an axial bore in which the non-return valve is located.

6. Equipment according to any one of the preceding claims, wherein the non-return valve of said at least one prop is so arranged that it can be opened manually by said manually operable means to allow flow to the pressure medium chamber.

7. Equipment according to any one of the preceding claims, wherein the piston rod of said at least one prop is inserted, via an external screw thread, in an internal screw thread of a tubular prop member.

8. Equipment according to Claim 5, wherein the piston rod of said at least one prop is axially displaceably but angularly non-displaceably guided in the cylindrical housing.

9. Equipment according to Claim 5 or Claim 8, wherein the end of the piston rod of said at least one prop is connected to a dished guide member having a cylindrical internal wall which is arranged to slide over a cylindrical external wall of a head portion of the cylindrical housing.

10. Equipment according to Claim 9, wherein the cylindrical internal wall of the guide member and the cylindrical external wall of the head portion of the cylindrical housing of said at least one prop have axial grooves into which a pin is inserted.

11. Equipment according to Claims 2, 5 and 6 in combination, wherein the non-return valve of said at least one prop is arranged to be opened by means of a manually adjustable screw-threaded spindle and a valve stem of said manually operable means, said stem extending through the chamber of the means for exerting said biasing force and through the pressure medium chamber and the ends of said stem being supported in a base and in the intermediate wall of the cylindrical housing respectively.

12. Equipment according to Claim 11, wherein the barrier of said at least one prop is defined by a piston of resilient material and having lip-shaped peripheries which slide along the wall of the cylindrical housing and the valve stem.

13. Equipment according to any one of the preceding claims, wherein a closable bore extends through the piston rod from said cylinder of said at least one prop.

14. Equipment according to Claim 11, wherein a valve which communicates between the outside and said chamber of the means for exerting said biasing force is located in the base of the cylindrical housing of said at least one prop.

15. Construction equipment for supporting walls of trenches, wherein at least one prop is constructed, arranged and adapted to operate substantially as hereinbefore described with reference to Figures 1 and 2 or Figures 1 and 3 of the accompanying drawings.

16. A trench when constructed by construction equipment according to any one of the preceding claims.

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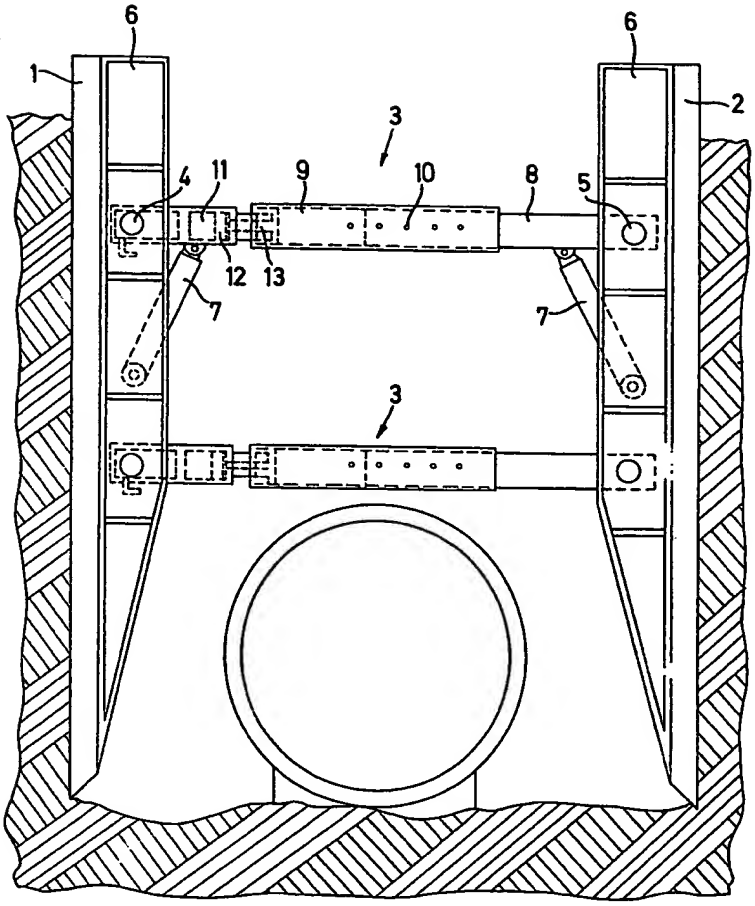
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1



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Sheet 2

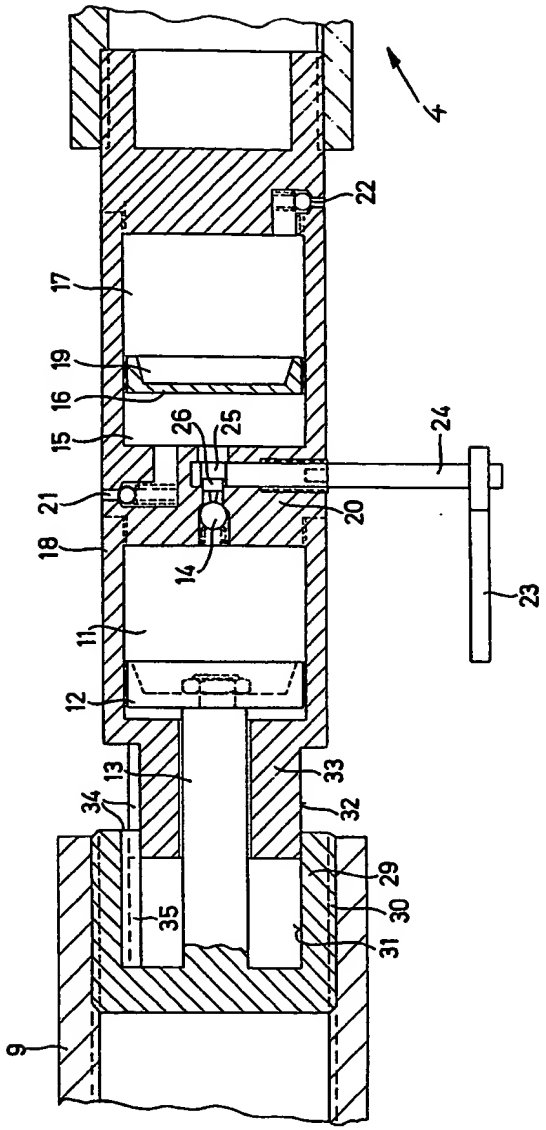

FIG. 2

1454022 COMPLETE SPECIFICATION
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Sheet 3

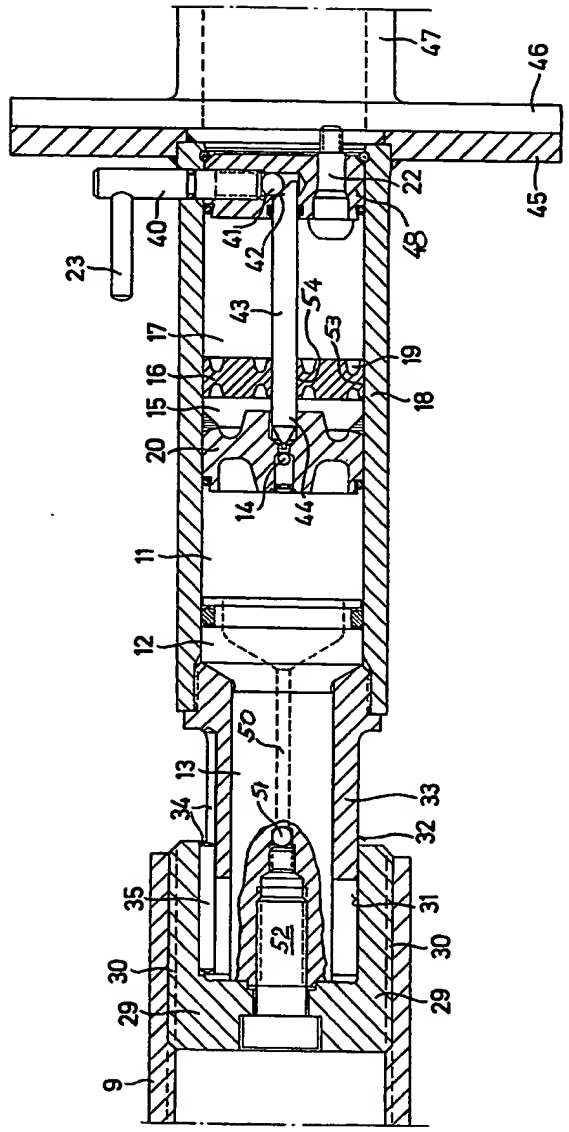

FIG. 3